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Spatial and Temporal Factors Affecting Agricultural Trade in the European Union (EU) and Economic Cooperation Organization (ECO)

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ABSTRACT

Export is an important factor in economic development and the creation of regional agreements is one of the ways to facilitate trade and exports; but measuring the success rate of these agreements is one of the challenges of this field. In this study, we compared the factors affecting agricultural exports and imports in the ECO and European Union countries. The purpose of this study was to assess the potential effects of countries' trade policies on the other countries that are in the same trade zone. To achieve this objective, we used spatial econometric techniques on data regarding the years between 1992 and 2013. The results showed that spatial effects were present in both trade zones. The comparison of coefficients of these variables in the import and export functions, led to the introduction of a new index which can be used as a criterion to evaluate the level of agricultural development in different trade zones.

Keywords: Agricultural export and import, Regional agreements trade, Spatial econometric.

INTRODUCTION

International trade, as a mechanism for global interaction, has had an important role in the type of development in different countries (Kneller *et al.,* 2008), which is the reason why commercial integration in key economic areas have been increasingly accelerated since the 1990's (Yang and Martinez-Zarzoso, 2014); in the same regard, the 2009 report of the World Bank acknowledged the trade as one of the three major factors in economic growth (World Bank 2009, 20). Many researchers believe that the increase in agricultural exports can lead to the growth of this sector (Valdes and Foster, 2005); because commercial agriculture has at least three potential advantages. First, it allows agriculture to compete in an international scale and this can increase the profits of this sector; secondly, the increased trade of agricultural products can qualitatively and quantitatively change the domestic demand for these products (Pingali and Khwaja, 2004); and third, it can change the lifestyle of communities especially in the case of middle-class (Reardon *et al.*, 2003). This is why we can see the transition from traditional agriculture to commercial agriculture in all developed countries.

According to economic theories, a country's trade policies can vary according to its location. This means that countries generally adjust their trade policies with regard to the trade policies of their neighbors and adjacent countries (Martincus, 2010, Gallup *et al.*, 1999, Wei, 2000). On the other hand, proximity of neighboring countries reduces the trade costs and this can have an effect on trade flows (Crozet and Koenig, 2004). Therefore, the spatial effects between the countries are confirmed (Kelejian *et al.*, 2012).

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On this basis, some studies have examined the spatial effects on trade; Porojan (2001) has studied the relation between spatial effects and trade flows by using a spatial econometric approach and has analyzed it in the case of imports and exports. Spatial econometrics has also been used in analysis of trade conducted by LeSage and Pace (2008). Najafi Alamdarlo *et al.* (2013) have studied the factors affecting the exports of agricultural products in the ECO countries. The study concluded that the proximity had a positive effect on agricultural exports. Chou *et al.* (2015) studied the factors affecting China's exports with its 40 partners from 1991 to 2008 using spatial econometrics. In this study, the spatial effects on China's exports have been approved. Boubacar (2015) studied the relationship between exports and FDI using simultaneous equations in NAFTA and using spatial econometric method. In this study, the spatial effects are confirmed both in FDI and export functions.

According to the research literature in this field, it is concluded that spatial effects have an impact on agricultural trade in areas that are geographically linked. Therefore, the purpose of this study is to evaluate the spatial effects on the export and import of agriculture products in two groups of different countries, the ECO countries which are generally developing countries and European Union countries which are developed countries. Also, we can assess the effects of spatial elements on agricultural exports and imports in the European Union (EU) and the Economic Cooperation Organization (ECO).

Economic Cooperation Organization (ECO) and European Union (EU)

Economic Organization Cooperation (ECO) was established in 1964 and has since expanded to include 10 members (Iran, Pakistan, Turkey, Afghanistan, Azerbaijan, Kazakhstan, Turkmenistan, Kyrgyzstan, Uzbekistan and Tajikistan). The objective of this organization has been to develop and improve the trade and investment in its member states, and its higher objective has been to create a single market similar to the European Union (EU). Figure 1 (a to d) shows the average values (average across years) of agricultural exports and imports in each of these two trade zones. Figure1 show that there have been some spatial effects in imports and exports.

The ratio of agricultural exports to the added value of agricultural sector in EU countries is 7.16 times more than ECO countries, but in the case of agricultural imports this ratio is 6.14 (WDI, 2014). So it can be stated that these countries have had more focus on exports rather than imports. On the other hand, between 1995 and 2013, the growth rate of agricultural exports and the growth rate of agricultural imports in EU countries have been 6.93% and 6.51% respectively. But in the same period, same parameters in ECO countries have been 7.36% for exports and 8.27% for imports. Therefore the trade balance has become more positive in EU and more negative in ECO.

As it can be seen in Figure 2, EU countries have a positive and regular trade balance in agricultural products, while ECO countries have a negative trade balance which has become increasingly more negative since 2006.

The purpose of this study is to obtain the effect of various factors on the real value of agricultural exports and imports in these two trade zones (EU and ECO). Another purpose of this study is to estimate spatial effects on agricultural trade value, because a country's trade policy on export or import of a product can be influenced by the commercial policies of some countries that are geographically linked to that country. Imitation of the trade policies of neighbors will affect the import and export value. Therefore, in this study it is assumed that ECO countries (as developing countries) have often complied with their neighbors on imports of agricultural products, but Eurozone countries (as developed countries)

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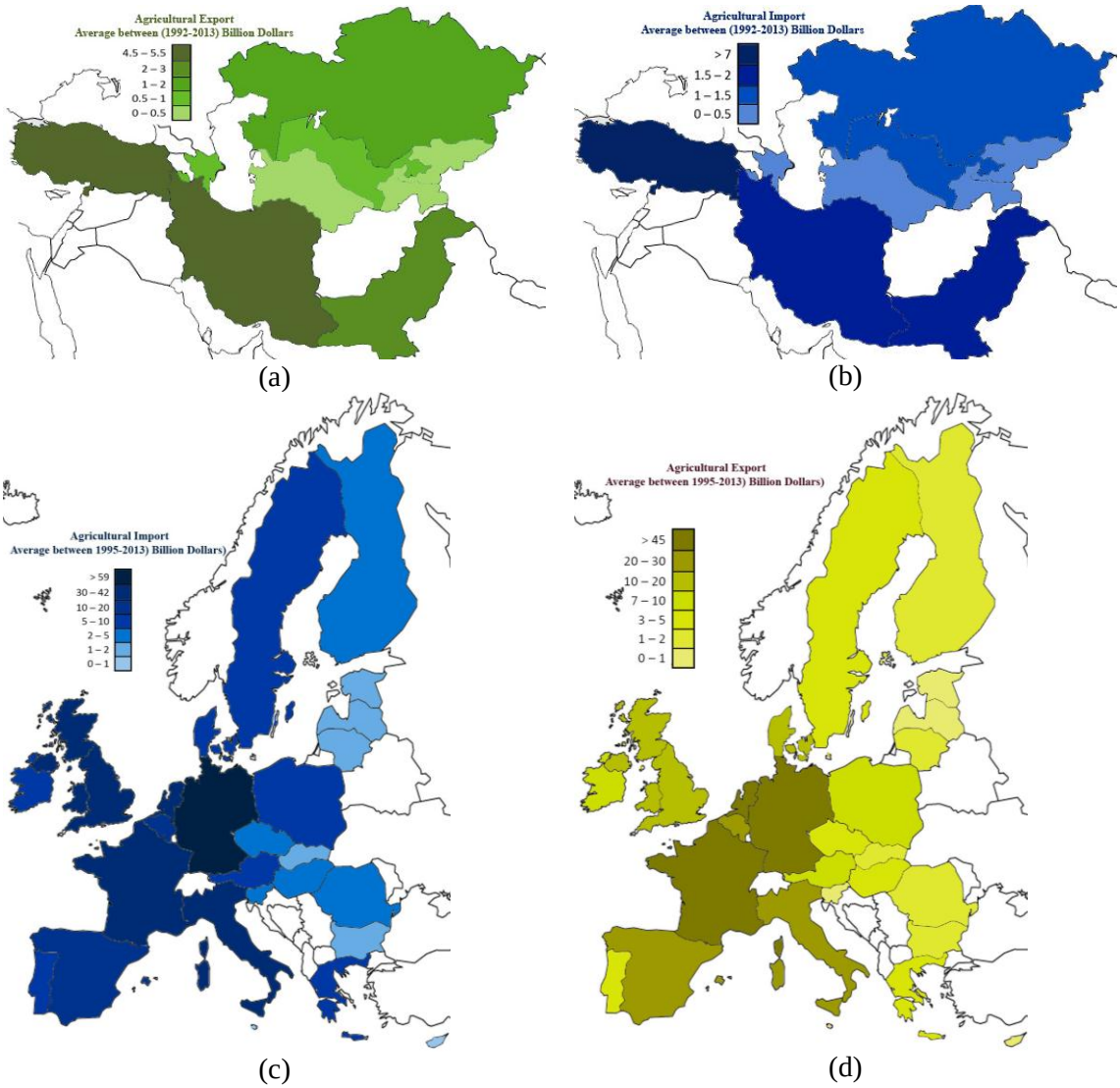

Figure1. (a) Agricultural export value in Economic Cooperation Organization (ECO) countries**.** (b) Agricultural import value in ECO countries. **(c)** Agricultural import value in European Union (EU) countries. (d) Agricultural export value in EU countries.

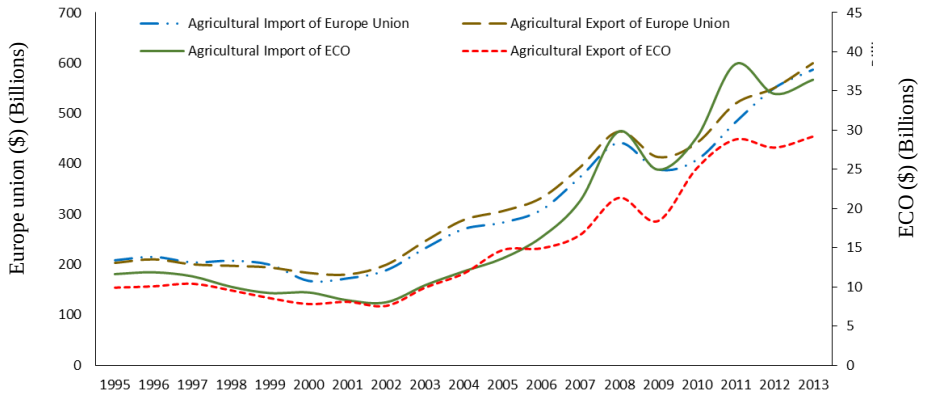

Figure 2. Agricultural import and export trend in EU and ECO.

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have often followed the import policies of their neighbors. One way to test this hypothesis is using spatial econometrics. Therefore, the innovation of this study is the determination of an index that can explain the gap between agricultural developments in these two different zones, examine the effects of foreign direct investment, and can also test the outputs obtained from maximum likelihood estimation and generalized method of moments by the use of spatial panel model.

MATERIALS AND METHODS

Panel data approach is a method for combining cross-sectional data and time-series data and provide a suitable environment for the development of estimation methods and theoretical results, and enable researchers to use cross-sectional time-series data in order to investigate those issues which cannot be studied only in a cross-sectional or a time-series. (Baltagi, 2009).

$$Y_{it} = \alpha_{it} + \sum_{k=2}^{K} \beta_{kit} X_{it} + \mu_i + \vartheta_{it} \quad (1)$$

In Equation (1), error term ϑ_{it} is normally distributed, and for any chosen value of ϑ_{it}, for every i and t is independent from X_{it}. Panel data can be estimated using fixed or random effects (Baltagi, 2009); but considering the weakness of these two methods in controlling correlation and heterogeneity between instrumental variables and disturbance, using the Generalized Method of Moments (GMM) is recommended (Al-mulali, 2015). When data distribution function is not identified, there is no possibility of using the maximum likelihood method; therefore GMM can be used. Also, to check the probability of explanatory variables endogeneity, the model can be estimated using Arellano–Bover/Blundell–Bond method (Arellano and Bond, 1991; Arellano and Bover, 1995). This method uses the lag of differential amount of endogenous explanatory variables as instrument variables. In this method, the validity of the instrumental variables is examined using Sargan test (Arellano and Bond, 1991).

For the first time in 1988, Anselin proposed spatial econometrics, which included the realities of spatial economics. He stated that conventional econometric methods are not suitable for regional studies, because in the data of regional studies, we are faced with two phenomenon of spatial dependence between the observations and the spatial heteroskedasticy. Therefore, the two models of spatial lag and spatial error are used for assessment in these types of studies (Anselin, 2001).

Spatial lag is a phenomenon that occurs in the data samples which contain spatial element, in a way that when there is an observation from a place like *i*, this observation is dependent on other observations from other places $i \neq j$. For this purpose we should obtain the contiguity matrix *W*. A dynamic model of spatial lag has the following format (Anselin *et al.*, 2007):

$$Y_{it} = \beta_1 Y_{it-1} + \beta_2 X_{it} + \beta_3 W Y_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

In this equation, i represents the region indicator, t is the time, WY_{it} is the first spatial lag, Y_{it-1} represents the lags of the dependent variable, and X_{it} is the other explanatory variables. The model above can be written in a way that would reflect the spatial error model as well. Therefore:

$$Y_{it} = \beta_1 Y_{it-1} + \beta_2 X_{it} + \beta_3 W Y_{it} + \alpha_i + \varepsilon_{it}$$

$$\varepsilon_{it} = \beta_4 W \varepsilon_{it} + \vartheta_{it} \quad (3)$$

In this equation, β_4 is the spatial error parameter that must be estimated. Dynamic spatial models can be estimated using three methods (Elhorst, 2011). The first method is the method of maximum likelihood. Another method is using Markov Chain Monte Carlo (MCMC). The third method is based on the instrumental variables approach or GMM (Generalized Method of Moments). In this study, we used the Arellano-Bover/Blundell-

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Bond method which is based on instrumental estimations method or GMM (Arrelano and Bond, 1991 and Blundell and Bond 1998). This method provides more efficient and more accurate estimates by improving accuracy and reducing bias (Baltagi, 2008). Due to the characteristics of the panel data, unit root test must be used to investigate its stationarity (Baltagi, 2009). This test is a unit root test for multiple series which is adapted to panel data. A variety of methods for applying unit root test for panel data have been proposed by Im, Pesaran and Shin (IPS) (2003), Maddala and Wu (1999), and Choi (2001), and they have been used in many studies.

The chosen explanatory variables in our application stem from previous literature (Khan, 1974; Pesaran, 1984, 1997; Bound, 1987; Frankel, 1993; Deardorff, 1995; Kalirajan, 2007, 2010; Khan and Kalirajan, 2011; Hailu, 2010; Aizenman and Noy, 2005 and Culem 1988). In particular, economic openness index, agriculture value-added at constant prices, Foreign Direct Investment (FDI) and Nominal exchange rate have been included in our empirical model (equation 3)".

Given that spatial econometric method was used, the following equation was used for estimation:

$$\begin{aligned} Y_{it} = \alpha_i + \beta_1 Y_{it-1} + \beta_2 ER_{it} + \beta_3 FDI_{it} \\ + \beta_4 AgriOpen_{it} \\ + \beta_5 AgriValue_{it} \\ + \beta_6 WY_{it} + \varepsilon_{it} \\ \varepsilon_{it} = \beta_7 W\varepsilon_{it} + \vartheta_{it} \end{aligned} \quad (4)$$

Where i refers to the cross-section dimension or country, t is time (year), Y_{it} is the value of agricultural exports or imports at constant prices (2005 US $), *ER* is the nominal exchange rate, and $AgriOpen$ is the degree of openness of agricultural trade that can be obtained through dividing the total value of agricultural imports and exports by the value added (at current prices); $AgriValue$ is the agriculture value-added at constant prices (2005 US $), WY_{it} is the spatial lag variable, and $W\varepsilon_{it}$ is the spatial error variable. This equation was estimated for the time period between 1995 and 2013 for EU and for the time period between 1992 and 2013 for ECO.

Choosing a spatial variable is very important in this model and it is obtained in two ways. Often, two spatial variables are used in spatial econometric studies on the trade, one of them is based on the proximity between the countries (Anselin and Arribas-Bell, 2013; Birkelof, 2010; Najafi Alamdarlo, 2016) and the other one is based on the weight matrix of distance between the countries (Blonigen *et al.*, 2007; Conley and Ligon, 2002; Gallo and Kamarianakis, 2011, Boubacar, 2015). In the first method, it was assumed that agricultural exports or imports in a region affect the adjacent regions which share a border with it. In accordance with this method, the weight value of 1 was assigned to countries which had a shared border and the value of 0 was assigned to other regions. So we obtained a matrix with 26 rows and 26 columns for the EU countries and a matrix with 9 rows and 9 columns for the ECO countries, and all entries in both matrixes were either zero or one. This matrix needed to be standardized, so that the sum of each row would become equal to one. In the second method, it is assumed that a common border is not the only reason for having a spatial effect. In this case, the Weight matrix is used, where each matrix element is equal to $\frac{1}{d_{ij}^2}$. Here d_{ij} is the air distance between the capitals of the two countries. Thus, according to these two types of spatial variable, there are two groups of countries and two groups of import and export variables. Finally, 12 functions are estimated.

RESULTS AND DISCUSSION

Before proceeding to model estimation, we must first consider the data presented in Table 1 regarding the reliability of the parameters and their characteristics. This table presents the mean values of the used variables and the method of determining

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Table 1. Statistic Summary and Panel Unit Root Test.[α]

Variable (Unit)	Description	ECO			EU		
		Mean	Panel Unit Root		Mean	Panel Unit Root	
			LLC[b]	IPS[c]		LLC	IPS
AG Export (Billion $)	$\frac{\text{Agricultural Export (current US\$)}}{\text{Export Value Index (2005 = 100)}}$	2.26	-4.9407 (0.0000)	-4.9206 (0.0000)	135.37	-3.3044 (0.0005)	-4.0697 (0.0000)
AG Import (Billion $)	$\frac{\text{Agricultural Import (current US\$)}}{\text{Import Value Index (2005 = 100)}}$	2.24	-1.7775 (0.0377)	-4.5196 (0.0000)	138.33	-2.3434 (0.0096)	-2.7957 (0.0026)
Exchange Rate (Local Currency VS Dollar)	Nominal Exchange Rate	881.48	-8.7529 (0.0000)	-3.4013 (0.0003)	10.58	-14.3633 (0.0000)	-6.8181 (0.0000)
FDI (Billion $)	Foreign direct investment, net inflows (BoP, current US$)	2.37	-2.03 (0.0211)	-4.6315 (0.0000)	4.71	-4.4571 (0.0000)	-9.2025 (0.0000)
AG Trade Open Degree	$\frac{\text{Agricultural Export (current US\$)} + \text{Agricultural Import (current US\$)}}{\text{Agriculture, value added (current US\$)}}$	0.48	-6.4573 (0.0000)	-5.0312 (0.0000)	3.17	-6.4573 (0.0000)	-5.2277 (0.0000)
AG Value Added (Billion $)	Agriculture, value added (constant 2005 US$)	10.04	-4.9487 (0.0000)	-2.3856 (0.0085)	8.461	-5.6204 (0.0000)	-7.5363 (0.0000)
Spatial AG Export (Distance)	$W_D \times \frac{\text{Agricultural Export (current US\$)}}{\text{Export Value Index (2005 = 100)}}$	8.554	-0.6251 (0.2659)	-3.7354 (0.0001)	4877.7	-4.0269 (0.0000)	-5.6018 (0.0000)
Spatial AG Export (Contiguity)	$W_A \times \frac{\text{Agricultural Export (current US\$)}}{\text{Export Value Index (2005 = 100)}}$	2.02	-1.6255 (0.0520)	-4.0104 (0.0000)	157.3	-3.4294 (0.0000)	-4.7883 (0.0000)
Spatial AG Import (Distance)	$W_D \times \frac{\text{Agricultural Import (current US\$)}}{\text{Import Value Index (2005 = 100)}}$	9.83	1.9977 (0.9771)	-5.4183 (0.0000)	4447.1	0.2943 (0.6157)	-1.5215 (0.0641)
Spatial AG Import (Contiguity)	$W_A \times \frac{\text{Agricultural Import (current US\$)}}{\text{Import Value Index (2005 = 100)}}$	2.64	-0.5139 (0.3037)	-4.7728 (0.0000)	170.8	-0.8214 (0.2057)	-3.4809 (0.0002)

[α] W is Contiguity matrix. The number in parentheses indicates the P-Value. The Stationary test was conducted for Logarithmic Value. [b] Adjusted t* Statistic Reported. Included Time trend. LLC= Levin-Lin-Chu. [c] Z-t-tilde-bar Statistic Reported. Resources: World Bank Data (2014), Trade Map Data (2015) and Research Finding.

them. The IPS and LLC panel unit root test was used to test for stationary.

Statistics shown in Tables 2 and 3, confirm the validity of estimated models. The instrument variables are shown in these tables. The Sargan value in GMM method indicates that instrumental variables addressed in Table 2 and 3, are selected properly. Tables 2 and 3 show the estimation results of function of agricultural export and import in ECO and EU countries. Increased trade openness and value-added has led to an increase in agricultural exports and imports. Positive relationship between GDP, import and export has been verified by Zestos and Tao (2002) and Boubacar (2015).

The effect of foreign direct investment on imports and exports is not completely clear (Hailu, 2010), and they often have a bilateral relationship with each other (Aizenman and Noy, 2005 and Culem, 1988); this variable does not have a significant effect on the agricultural export and import of ECO countries in the estimated model (Tables 2 and 3); and the reason behind this can be the lack of proper distribution of these funds among economic sectors (Jeon, 1992; Blomstrom *et al.*, 1988; Blonigen 2001). The effect of this variable on import and export in EU countries has been positive. This finding is inconsistent with Ma *et al.*, (2000) research, but it is consistent with Blonigen (2001) study.

The existence of spatial error and spatial lag effects has been accepted in both estimation function in Tables 2 and 3. Thus, agricultural exports in these countries also result from exports in the neighboring countries, and this can be caused by emulation of neighboring countries' trade

Table 2. Agricultural export function in ECO and EU countries.

	ECO			EU		
	Model I	Model II	Model III	Model IV	Model V	Model VI
Variables	Contiguity spatial matrix	Distance spatial matrix	Non spatial	Contiguity spatial matrix	Distance spatial matrix	Non spatial
Constant	-2.284 (0.001)***	-1.22 (0.278)*	-1.417 (0.008)***	1.88 (0.009)***	1.172 (0.029)**	0.207 (0.520)
AG export value lag	0.65 (0.000)***	0.674 (0.000)***	0.676 (0.000)***	0.632 (0.000)***	0.715 (0.000)***	0.753 (0.000)***
AG value added	0.439 (0.000)***	0.416 (0.000)***	0.417 (0.000)***	0.05 (0.677)	0.0448 (0.681)	0.207 (0.000)***
FDI	-0.0477 (0.021)**	-0.0463 (0.029)**	-0.0447 (0.033)**	0.0063 (0.017)**	0.004 (0.179)	0.0099 (0.000)***
AG trade open degree	0.502 (0.000)***	0.455 (0.000)***	0.46 (0.000)***	0.181 (0.000)***	0.154 (0.000)***	0.245 (0.000)***
Exchange rate	-0.0223 (0.228)	-0.0365 (0.051)*	-0.0344 (0.048)**	0.0055 (0.731)	0.01 (0.492)	-0.0326 (0.010)**
Spatial lag	0.127 (0.082)*	0.031 (0.097)*		0.208 (0.037)**	0.178 (0.006)***	
Spatial error	0.427 (0.000)***	0.0067 (0.682)		-1.073 (0.000)***	-0.012 (0.000)***	
OBS	189	189	198	468	468	189
Wald *Chi*2	634.4	607.46	612.1	33766.5	21051.6	24233.9
Sargan test	156.1 (0.6351)	154.1 (0.6786)	151.9 (0.7226)	19.3 (1.0000)	21.13 (1.0000)	25.1 (1.0000)
Instruments for differenced equation	GMM-type: L(2/.).(Depended variable) Standard D (Independed variables)					
Instruments for level equation	GMM-type LD (Depended variable) Standard _Cons					

Resources: Research finding.

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Table 3. Agricultural import function in ECO and EU countries.

Variables	ECO			EU		
	Model VII	Model VIII	Model IX	Model X	Model XI	Model XII
Variables	Contiguity spatial matrix	Distance spatial matrix	Non spatial	Contiguity spatial matrix	Distance spatial matrix	Non spatial
Constant	-1.275 (0.000)***	-1.35 (0.006)***	-1.01 (0.001)***	0.617 (0.259)	0.542 (0.287)	0.476 (0.353)
AG export value lag	0.614 (0.000)***	0.627 (0.000)***	0.623 (0.000)***	0.57 (0.000)***	0.59 (0.000)***	0.651 (0.000)***
AG value added	0.295 (0.000)***	0.336 (0.000)***	0.341 (0.000)***	0.188 (0.015)**	0.189 (0.008)***	0.26 (0.000)***
FDI	0.0066 (0.576)	0.0142 (0.232)	0.0182 (0.106)	0.0061 (0.000)***	0.0043 (0.005)***	0.0076 (0.000)***
AG trade open degree	0.403 (0.000)***	0.417 (0.000)***	0.419 (0.000)***	0.237 (0.000)***	0.239 (0.000)***	0.26 (0.000)***
Exchange rate	-0.0062 (0.652)	-0.0085 (0.486)	-0.015 (0.192)	-0.028 (0.038)**	-0.046 (0.000)***	-0.0446 (0.000)***
Spatial lag	0.134 (0.007)***	0.0573 (0.018)**		0.148 (0.054)*	0.118 (0.077)*	
Spatial error	-0.254 (0.098)*	-0.015 (0.353)		-0.741 (0.000)***	0.003 (0.164)	
OBS	189	189	189	468	468	468
Wald *Chi*2	1781.9	1704.5	1699.7	21003.4	19176.4	18912.8
Sargan test	162.6 (0.4936)	165.8 (0.4229)	163.04 (0.4842)	22.87 (1.0000)	23.19 (1.0000)	24.99 (1.0000)
Instruments for differenced equation	GMM-type: Standard	L(2/.).(Depended Variable D (Independed variables)				
Instruments for level equation	GMM-type: Standard	LD.(Depended variable) _Cons				

Resources: Research finding.

policies (Porojan, 2001 and Boubacar, 2015). Both groups of countries act through trade zones so the presence of spatial effects was expected. On the other hand, the lagged agricultural exports coefficient has a higher effect than the spatial variable coefficient, although with a lag which reflects the effect of time; so it can be said that the role of time has been more effective than the role of space. Also, spatial variable coefficient has had a positive effect on imports in both trade zones (Najafi Alamdarlo, 2013; Boubacar, 2015). Therefore, it can be said that neighborhood or close distance between the two countries, can have a positive effect on the export or import of a country. In other words, the increase in the trade of a country affects the other country's trade value. The greater value of this factor indicates that the two countries have similar trade preferences, so if they form a trade union, the probability of success will be higher.

The exchange rate of the European Union and ECO countries had a negative effect on imports (Baek, 2014). The effect of this variable is higher in developed countries. The effect of exchange rate on exports has been negative in the ECO countries, but had no significant effect on it. The small variable coefficient of exchange rate indicates that the variable has a low impact on exports. The negative sign between exports and exchange rate and lake of significant impact have also been reported in Baek's study (2014).

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Using spatial econometrics showed that there have been spatial effects in agricultural trade of both trade zones, but its value and ratio was different in these two areas. Therefore, the main contribution of this research is to introduce an index that can explain one of the reasons of the gap of agricultural growth in developing and developed countries. The value of this index and the method of its calculation are shown in Table 4:

The value of this index in EU is equal to 1.51, but in ECO it is equal to 0.54; therefore in the ECO countries, the effect of contiguity on agricultural imports was higher than this effect on agricultural exports. But in EU countries, this process was reversed. If the value of this index would be less than 1, it can be seen as a new criterion for assessing the agricultural development of different trade zones.

Table 5 shows the IPS and LLC test results of the panel unit root analysis of estimated functions residuals. Based on these results, all values are stationary and significant at the level of 1%, and this can indicate the validity of estimated coefficients in the import and export functions.

CONCLUSIONS

The purpose of this study was to investigate and compare the factors affecting agricultural trade in the European Union (developed countries) and the ECO (developing countries) trade zones. To

Table 4. New index for evaluating the level of agricultural development in EU and ECO.

New spatial index	EU		ECO	
	Distance spatial matrix	Contiguity spatial matrix	Distance spatial matrix	Contiguity spatial matrix
$SNI = \frac{\text{Spatial Lag Coefficient in Import Regression}}{\text{Spatial Lag Coefficient in Import Regression}}$	1.41	1.51	0.94	0.54

Resources: Research finding.

Table 5. Panel unit root test for residuals.[a]

		ECO			EU		
	Test	Distance spatial matrix	Contiguity spatial matrix	Non spatial	Distance spatial matrix	Contiguity spatial matrix	Non spatial
Export	IPS[a]	-7.6346 (0.0000)	-7.4968 (0.0000)	-7.6427 (0.0000)	-10.2927 (0.0000)	-9.7326 (0.0000)	-9.8509 (0.0000)
	LLC[b]	-7.1714 (0.0000)	-7.3273 (0.0000)	-7.1965 (0.0000)	-9.6953 (0.0000)	-9.0009 (0.0000)	-9.8142 (0.0000)
Import	IPS	-7.0733 (0.0000)	-7.0850 (0.0000)	-7.0498 (0.0000)	-9.5107 (0.0000)	-9.4913 (0.0000)	-9.4552 (0.0000)
	LLC	-4.6561 (0.0000)	-4.9752 (0.0000)	-4.5868 (0.0000)	-9.2878 (0.0000)	-10.0465 (0.0000)	-9.3465 (0.0000)

[a] The number in parentheses indicates the *P*-value. [b] Im-Pesaran-Shin. Common AR; included panel mean; included time trend, Z-t-tilde-bar statistic reported. [c] Levin-Lin-Chu. Panel specific AR; included panel mean included time trend, adjusted *t** statistic reported.

Resources: Research finding.

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achieve our objective, we used the data for the period between 1992 and 2013 for the ECO countries and between 1995 and 2013 for the EU countries. Spatial dynamic panel data method was used to obtain the effect of adjacency in the trade of agricultural products. A common border can be an important factor in increasing exports of one country to another. Thus a common geographical border or less distance between the two countries has a major role in the decision making of the countries. In this study, the spatial effects between ECO and European Union countries have been approved, with the exception that ECO countries are generally focused on imports, but European Union countries consider export to be more important. It is clear that the European Union is a very successful model for a trade union. Thus, as expected, the coefficient value of the spatial variable in the estimation of import and export functions of European Union countries has been more than ECO countries. One reason may be commercial coordination and convergence between these groups of countries. According to estimates, the presence of dynamic effects was observed in four estimated models (import and export function in ECO and EU). Foreign direct investment had a negative impact on agricultural exports in ECO countries, and did not lead to the development of agricultural trade in these regions. The increase in value added and economic openness in the agricultural sector can lead to an increase in imports and exports. The exchange rate of agricultural products in both groups of countries has a negative (Mosavi *et al.,* 2014), but low effect on import, but had no significant effect on exports. Because if we accept exports as a stimulus for economic development, in developed countries such as countries in EU, the potential of being affected by neighboring countries export policies has been higher than the same factor for import policies. Given that the value of this index in Europe is (1.5//0.54) 2.8 times more than the ECO countries, it can be stated that EU countries are three times more developed than the ECO countries in the field of agricultural trade. It is therefore recommended that ECO countries focus more on the development of agricultural exports to be able to improve the mentioned index and reach a sustainable development.

REFERENCES

1. Aizenman, J. and I. Noy. 2005. *FDI and Trad: Two-way Linkages?* Working Paper Series No. 11403, National Bureau of Economic Research, Cambridge, Massachusetts.
2. Al-Mulali, U., Weng-Wai, C., Sheau-Ting, L. and Mohammed, A. H. 2015. Investigating the Environmental Kuznets Curve (EKC) Hypothesis by Utilizing the Ecological Footprint as an Indicator of Environmental Degradation. *Ecol. Indic.*, **48:** 315–323.
3. Anselin, L. 1988. Spatial Econometrics, Methods and Models, *Kluer Academic*, Boston.
4. Anselin, L. 2001. Spatial Econometrics. In: "*A Companion to Theoretical Econometrics*", (Ed.): Baltagi, B. Blackwell, Oxford, PP. 310–330.
5. Anselin, L. and Arribas-Bel, D. 2013. Spatial Fixed Effects and Spatial Dependence in a Single Cross-section. *Pap. Reg. Sci.,* **92(1):** 3-17.
6. Anselin, L., Le Gallo, J. and Jayet, J. 2007. Spatial Panel Econometrics. Chapter 19. In: "*The Econometrics of Panel Data, Fundamentals and Recent Developments in Theory and Practice*", (Eds.): Matyas L. and Sevestre P. 3rd Edition, Kluwer Academic Publishers.
7. Arellano, M. and Bond, S., 1991. Some Tests of Specification for Panel Data: Monte Carloevidence and an Application to Employment Equations. *Rev. Econ. Stud.*, **58:** 277–297.
8. Arellano, M., and Bover, O. 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics, **68**: 29-51.
9. Baek, J. 2014. Exchange Rate Effects on Korea–US Bilateral Trade: A New Look. *Res. Econom.,* **68(3):** 214–221.

[DOR: 20.1001.1.16807073.2016.18.7.14.4]

10. Baltagi, B. H. 2005. *Econometric Analysis of Panel Data*. Third Edition, John Wiley and Sons, New York.
11. Baltagi, B. H. 2008. *Econometric Analysis of Panel Data*. John Wiley and Sons Ltd., Chichester.
12. Baltagi, B. H.2009. *Econometric Analysis of Panel Data.* John Wiley and Sons Ltd., UK.
13. Bergstrand, J. H. 1985. The Gravity Equation in International Economic Foundations and Empirical Evidence. *Rev. Econ. Stat.*, **67:** 474–481.
14. Birkelof, L. C. 2010. Exploring Differences in Expenditure for the Functionally Impaired: Neighborhood Interaction and the Federal Structure, *Ann. Reg. Sci.,* **44(1):**185-204.
15. Blomström, M., Lipsey, R. E. and Kulchycky, K. 1988. US and Swedish Direct Investment and Exports: Trade Policy Issues and Empirical Analysis. Chicago University Press, Chicago.
16. Blonigen, B. A. 2001. In Search of Substitution between Foreign Production and Exports. *J. Int. Econ.*, **53(1):** 81-104.
17. Blonigen, B. A., Davies, R. B., Waddell, G. R. and Naughton, H. T. 2007. FDI in Space: Spatial Autoregressive Relationships in Foreign Direct Investment. *Eur. Econ. Rev.*, **51:** 1303-1325.
18. Blundell, R. and Bond, S. 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *J. Econ.*, **87(1):** 115-143
19. Boubacar, I. 2015. Spatial Determinants of US FDI and Exports in OECD Countrie. *Econ. Syst.*, http://dx.doi.org/10.1016/j.ecosys.2015.04.005.
20. Bound, E. 1987. An Econometric Study a Primary Commodity Exports from Development Country Regions to World. *IMF*, **84(2):** 191 – 227.
21. Brueckner, J. K. 2003. Strategic Interaction among Governments: An Overview of Empirical Studies. *Int. Reg. Sci. Rev.*, **26:** 175–188.
22. Choi, I. 2001. Unit Root Tests for Panel Data. *J. Int. Money Finance*, **20:** 249–272.
23. Chou, K. H., Chen, C. H. and Mai, C. C. 2015. Factors Influencing China's Exports with a Spatial Econometric Model. *Int. Trade J.*, **29(3):** 191-211.
24. Conley, T. G. and Ligon, E. 2002. Economic Distance and Cross-country Spillovers. *J. Econ. Growth*, **7(2):** 157-187.
25. Crozet, M. and Koenig, P. 2004. EU Enlargement and the Internal Geography of Countries, *J. Comp. Econ.*, **32(2):** 265–279.
26. Culem, C. G. 1988. The Locational Determinants of Direct Investment among Industrialized Countries. *Eur. Econ. Rev.*, **32(4):** 885-904.
27. Deardorff, A. 1995. Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World? NBER Working Papers No. 5377.
28. Devereux, M., Lockwood, B. and Redoano, M. 2002. *Do Countries Compete on Corporate Tax Rates?* CEPR Discussion Paper Series, 3400.
29. Dreher, A. 2006. The Influence of Globalization on Taxes and Social Policy: An Empirical Analysis for OECD Countries. *Eur. J. Polit. Econ.*, **22(1):** 179–201.
30. Elhorst, J. P. (2011). Spatial panel models. York, UK: The University of York.
31. Frankel, J. A. 1993. Is Japan Creating a Yen Bloc in the East Asia and the Pacific? In: "*Regionalism and Rivalry: Japan and the United States in Pacific Asia*", (Eds.): Frankel, J. A. and Kahler, M. University of Chicago Press, Chicago.
32. Gallo, J. L. and Kamarianakis, Y. 2011. The Evolution of Regional Productivity Disparities in the European Union from 1975 to 2002: A Combination of Shift–Share and Spatial Econometrics. *Reg. Stud.*, **45(1):** 123-139.
33. Gallup, J. L., Sachs, J. D. and Mellinger, A. D. 1999. Geography and Economic Development, *Int. Reg. Sci. Rev.*, **22:** 179-232.
34. Hailu, A. Z. 2010. Impact of Foreign Direct Investment on Trade of African Countries. *Int. J. Econ. Finance*, **2(3):** 122-133.
35. Hanson, G. 1998. Regional Adjustment to Trade Liberalization. *Reg. Sci. Urban. Econ.*, **28(4):** 419–444.
36. Im, K. S., Pesaran, M. H. and Shin, Y. 2003. Testing for Unit Roots in Heterogeneous Panels. *J. Econ.*, **115:** 53–74.
37. Jeon, Y. D. 1992. The Determinants of Korean Foreign Direct Investment in Manufacturing Industries. *Weltwirtschaftliches Archiv*., **128(3):** 527-542 ·

[DOR: 20.1001.1.16807073.2016.18.7.14.4]

38. Kalirajan, K. 2010. Sources of Variation in Export Flows over Time: A Suggested Methodology of Measurement. *Int. J. Business Econ.*, **9(2):** 175–178.
39. Kalirajan, K. P. 2007. Regional Cooperation and Bilateral Trade Flows: An Empirical Measurement of Resistance. *Int. Trade J.*, **21(2):** 85–107.
40. Kelejian, H., Tavlas, S. G. and Petroulas, P. 2012. In the Neighborhood: The Trade Effects of the Euro in a Spatial Framework. *Reg. Sci. Urban. Econ.*, **42**: 314–322.
41. Khan, I. U. and Kalirajan, K. 2011. The Impact of Trade Costs on Exports: An Empirical Modeling. *Econ. Model.*, **28:** 1341-1347.
42. Khan, M. 1974. Import and Export Demand in Developing Countries. Staff Papers, IMF, **11(3).**
43. Kneller, R., Morgan, C. W. and Kanchanahatakij, S. 2008. Trade Liberalization and Economic Growth. *World Econ.*, **31(6)**: 701–719.
44. LeSage, P. J. and Pace, R. K. 2008. Spatial Econometric Modeling of Origin-destination Flows. *J. Regional Sci.*, **48(5):** 941-967.
45. Levin, A., Lin, C. F. and Chu, C. S. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties. *J. Econ.*, **108:** 1–24.
46. Ma, Y., Morikawa, K. and Shone, R. 2000. A Macroeconomic Model of Direct Investment on Foreign Affiliates of Japanese Firms. *Jpn. World Econ.*, **12:** 311-335.
47. Maddala, G. S. and Wu, S. A. 1999. Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bull. Econ. Stat.*, **108**: 1–24.
48. Martincus, V. C. 2010. Spatial Effects of Trade Policy: Evidence from Brazil. *J. Regional Sci.*, **50(2)**: 541–569.
49. Mosavi, S. H., Esmaeili, A. K. and Azhdari, S. 2014. Evaluating Economic Effects of Exchange Rate Depreciation on the Rice Market in Iran. *J. Agr. Sci. Tech.*, **16(4):** 705-715.
50. Najafi Alamdarlo, H. 2016. Water consumption, agriculture value added and carbon dioxide emission in Iran, environmental Kuznets curve hypothesis. *Int. J. Environ. Sci. Technol.* **13(8)**: 2079-2090.
51. Najafi Alamdarlo, H., Mortazavi, S. A. and Shemshadi Yazdi, K. 2013. Application of Spatial Econometrics in Agricultural Exports in ECO Members: Panel Data Approach. *The Econ. Res.*, **13(3):** 49-62. (in Persian).
52. Pesaran, M. H. 1984. Macroeconomic Policy in an Oil-exporting Economy white Foreign Exchange Controls. *Economica*, **51:** 253-270.
53. Pesaran, M. H., Kim, K. and Williamson, S. D. 1997. Measuring Globalization Industries and National Industry Approach: Empirical Evidence across Five Countries and over Time. Journal and International Business Studies, Fourth Quarter.
54. Pingali, P. L. and Khwaja, Y. 2004. Globalization of Indian Diets and the Transformation of Food Supply Systems. ESA Working Paper No. 04-05, FAO, Rome, Italy.
55. Porojan, A. 2001. Trade Flows and Spatial Effects: The Gravity Model Revisited. *Open. Econ. Rev.*, **12**: 265-280.
56. Reardon, T., Timmer, C. P., Barrett, C. and Berdegue, J. 2003. The Rise of Supermarkets in Africa, Asia, and Latin America. *Am. J. Agr. Econ.*, **85(5):** 1140-1146.
57. Tsuki, T., Wilson, J. S. and Sewadeh, M. 2001. What Price Precaution? European Harmonization of Aflatoxin Regulations and African Groundnut Exports. *Eur. Rev. Agric. Econ.*, **28(2):** 263–283.
58. Valdes, A., and Foster, W. 2005. Reflections on the Role of Agriculture on Pro-Poor Growth. World Development, **38(10)**: 1362–1374.
59. WDI (World Development Indicator). 2014. The World Bank.
60. Wei, S. J. 2000. Natural Openness and Good Government. NBER Working Paper No. 7765, Cambridge, MA.
61. World Bank. 2009. World Development Report 2009: Reshaping Economic Geography. World Bank, Washington, DC.
62. Yang, Sh., and Martinez-Zarzoso, I. 2014. A panel data analysis of trade creation and trade diversion effects: The case of ASEAN–China Free Trade Area. China Economic Review, **29**: 138-151.
63. Zestos, G. K. and Tao, X. 2002. Trade and GDP Growth: Causal Relations in the United States and Canada. *South. Econ. J.*, **68(4):** 859-874.

[DOR: 20.1001.1.16807073.2016.18.7.14.4]

آثار عوامل فضایی و زمانی موثر بر تجارت کشاورزی در اتحادیه اروپا و کشورهای عضو اکو

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چکیده

صادرات به عنوان یک عامل مهم در توسعه اقتصادی به شمار می‌رود و یکی از راههای تسهیل آن، ایجاد پیمان های منطقه ای میباشد، اما یکی از چالشهای پیش رو بررسی میزان موفقیت این پیمانها میباشد. بر این اساس در این مطالعه، عوامل موثر بر صادرات و واردات کشاورزی در کشورهای اتحادیه اروپا و کشورهای اکو مورد مقایسه قرار گرفته است. هدف از این مطالعه، مقایسه میزان تاثیر پذیری الگوی تجاری کشورها، با توجه به سایر کشورهایی هست که در همان اتحادیه وجود دارند. برای این منظور از روش اقتصاد سنجی فضایی در بین سالهای ۱۹۹۲ تا ۲۰۱۳ استفاده شده است. نتایج نشان داد که اثرات فضایی در هر دو اتحادیه تجاری وجود دارد. مقایسه ضریب این متغیرها در توابع واردات و صادرات، منجر به معرفی یک شاخص جدید شده است که میتواند به عنوان معیاری برای قضاوت در مورد درجه توسعه یافتگی در حوزه کشاورزی در مناطق تجاری مختلف باشد.

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